

**Utah Division of Water Quality
ADDENDUM
Statement of Basis
Wasteload Analysis for Permit Renewal**

Date: July 14, 2016

Facility: Moab POTW
UPDES No. UT0020419

Receiving water: Colorado River (1C, 2A, 3B, 4)

This addendum summarizes the wasteload analysis that was performed to determine water quality based effluent limits (WQBEL) for this discharge. Wasteload analyses are performed to determine point source effluent limitations necessary to maintain designated beneficial uses by evaluating projected effects of discharge concentrations on in-stream water quality. The wasteload analysis also takes into account downstream designated uses (UAC R317-2-8). Projected concentrations are compared to numeric water quality standards to determine acceptability. The numeric criteria in this wasteload analysis may be modified by narrative criteria and other conditions determined by staff of the Division of Water Quality.

Discharge

Outfall 001: Located at latitude 38°34'40" and longitude 109°34'47". The discharge is through a 2,000-lineal-foot, 18-inch diameter reinforced concrete pipeline to the Colorado River.

The design flow for the treatment plant is 1.50 MGD maximum monthly average and 3.00 MGD maximum daily discharge, as provided by the permittee. The design discharge was used for this wasteload analysis.

Data obtained from 2004-2014 for sampling site 4956550 Moab WWTP was used to characterize the temperature, pH and hardness of the effluent.

Receiving Water

The receiving water for the discharge is the Colorado River, which per UAC R317-2-13.1 has designated uses of 1C, 2A, 3B, and 4.

- *Class 1C - Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water.*
- *Class 2A - Protected for frequent primary contact recreation where there is a high likelihood of ingestion of water or a high degree of bodily contact with the water. Examples include, but are not limited to, swimming, rafting, kayaking, diving, and water skiing.*
- *Class 3B - Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.*
- *Class 4 - Protected for agricultural uses including irrigation of crops and stock watering.*

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The critical flow for the wasteload analysis was considered the lowest stream flow for seven consecutive days with a ten year return frequency (7Q10). Flow records from USGS stream gage # 09180500 - COLORADO RIVER NEAR CISCO, UT, for the period 1913 – 2010 was obtained. The 7Q10 was calculated using the EPA computer software DFLOW V3.1b.

7Q10 Flow (Annual) = 1,220 cfs

Data obtained from 2004-2014 for sampling site 4957000 Colorado River at US191 Crossing Near Moab was used to characterize background water quality conditions.

Mixing Zone

The allowable mixing zone is 15 minutes of travel time for acute conditions, not to exceed 50% of stream width, and 2,500 feet for chronic conditions, per UAC R317-2-5. Water quality standards must be met at the end of the mixing zone. Individual mixing zones may be further limited or disallowed in consideration of the following factors in the area affected by the discharge: Zone of passage for migrating fish or other species (including access to tributaries).

Mill Creek confluence with the Colorado River is approximately 1,400 feet downstream of the Moab POTW outfall pipe. Therefore, in consideration of potential fish migration concerns between Mill Creek and Colorado River, the acute mixing zone is limited to 1,400 feet (calculated to be 10.2 minutes travel time).

Dilution Factor

The EPA Region 8 stream mixing zone analysis (STREAMIX1, 1994), was used to determine the plume width and mixed flow rate for both acute and chronic conditions. A rectangular channel with a width of 300 feet, channel slope of 0.001 feet/foot, and roughness coefficient of 0.030 was assumed for channel geometry. Manning’s equation was used to solve for the flow depth (1.8 feet) and velocity for the 7Q10 flow.

Table 1: Summary of plume characteristics at mixing zone boundary.

Criteria	Distance to End of Mixing Zone (feet)	Plume Width		Flow cfs	Dilution Factor
		feet	% of River		
Acute	1,400	35.4	11.6	142	47:1
Chronic	2,500	49.1	16.2	198	86:1

Parameters of Concern

The potential parameters of concern for the discharge/receiving water identified were total dissolved solids (TDS), total suspended solids (TSS), ammonia, and dissolved metals as determined in consultation with the UPDES Permit Writer.

TMDL

The Colorado River from Green River confluence to Moab was listed as impaired for selenium according to the 2010 303(d) list. The receiving water does not have an approved TMDL for any parameters.

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WET Limits

The percent of effluent in the receiving water in a fully mixed condition, and acute and chronic dilution in a not fully mixed condition are calculated in the WLA in order to generate WET limits. The LC₅₀ (lethal concentration, 50%) percent effluent for acute toxicity and the IC₂₅ (inhibition concentration, 25%) percent effluent for chronic toxicity, as determined by the WET test, needs to be below the WET limits, as determined by the WLA. The WET limit for LC₅₀ is typically 100% effluent and does not need to be determined by the WLA.

Table 2: WET Limits for IC₂₅

Season	Percent Effluent
Annual	1.2%

Effluent Limits

Effluent limits for pollutants were determined using a mass balance mixing analysis (UDWQ 2012). The mass balance analysis is summarized in Appendix A.

The water quality standard for chronic ammonia toxicity is dependent on temperature and pH, and the water quality standard for acute ammonia toxicity is dependent on pH. The analysis to determine the ammonia criteria is summarized in Appendix B.

Due to the high dilution factor, secondary standards for BOD₅ per Utah Administrative Code (UAC) R317-1-3.2 were considered sufficient to meet or exceed instream criteria for DO.

Table 3: Water Quality Based Effluent Limits Summary

Effluent Constituent	Acute			Chronic		
	Standard	Limit	Averaging Period	Standard	Limit	Averaging Period
Flow (MGD)		3.0	1 day		1.5	30 days
Ammonia (mg/L)			1 hour			30 days
Summer (Jul-Sep)	2.9	210		1.1	75	
Fall (Oct-Dec)	1.3	94		1.2	83	
Winter (Jan-Mar)	3.0	219		1.7	122	
Spring (Apr-Jun)	2.5	180		1.7	122	
BOD ₅ (mg/L) ¹	N/A	35	7 days	N/A	25	30 days

¹: Limits based on Utah Secondary Treatment Standards (UAC R317-1-3.2).

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Antidegradation Level I Review

The objective of the Level I ADR is to ensure the protection of existing uses, defined as the beneficial uses attained in the receiving water on or after November 28, 1975. No evidence is known that the existing uses deviate from the designated beneficial uses for the receiving water. Therefore, the beneficial uses will be protected if the discharge remains below the WQBELs presented in this wasteload.

The pollutant concentration and load from the facility is not changing under this permit renewal; therefore, a Level II Antidegradation Review (ADR) is not required for this discharge.

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Documents:

WLA Document: *moab_potw_renewal_wla_2016-07-13.docx*
Analysis: *moab_potw_renewal_wla_2016.xlsx*

References:

Utah Wasteload Analysis Procedures Version 1.0. 2012. Utah Division of Water Quality.

WASTELOAD ANALYSIS [WLA]

Date: 7/14/2016

Appendix A: Mass Balance Mixing Analysis for Conservative Constituents

Discharging Facility: Moab WWTP
 UPDES No: UT-0020419
 Permit Flow [MGD]: 3.38 Annual Max. Daily
 1.75 Annual Max. Monthly

Receiving Water: Colorado River
 Stream Classification: 1C, 2B, 3B, 4
 Stream Flows [cfs]: 1220 Summer Critical Low Flow
 198 Chronic
 142 Acute

Fully Mixed: NO
 Acute River Width: 11.6% Plume Model Used
 Chronic River Width: 16.2% Plume Model Used

Modeling Information

A simple mixing analysis was used to determine the effluent limits.

All model numerical inputs, intermediate calculations, outputs and graphs are available for discussion, inspection and copy at the Division of Water Quality.

Effluent Limitations

Current State water quality standards are required to be met under a variety of conditions including in-stream flows targeted to the 7-day, 10-year low flow (R317-2-9).

Other conditions used in the modeling effort reflect the environmental conditions expected at low stream flows.

Effluent Limitations for Protection of Drinking Water (Class 1C Waters)

No dilution in unnamed irrigation ditch.

Dissolved Metals (ug/L)	Maximum Concentration		
	Standard	Background	Limit
Arsenic	10.0	1.30	246
Barium	1000	140.60	24,331
Beryllium	4.0	2.68	39.8
Cadmium	10.0	0.10	279
Chromium	50.0	2.00	1,353
Lead	15.0	0.20	417
Mercury	2.0	0.2	51
Selenium	50.0	2.20	1,348
Silver	50.0	0.5	1,394

Inorganics (mg/L)	Maximum Concentration		
	Standard	Background	Limit
Bromate	0.01	0.007	0.10
Chlorite	1.0	0.67	10.0
Fluoride	1.4	0.94	13.9
Nitrate	10.0	0.51	268

Radiological (pCi/L)	Maximum Concentration		
	Standard	Background	Limit
Gross Alpha	15.0	10.1	149
Gross Beta	4.0	2.7	39.8
Strontium 90	8.0	5.4	80
Tritium	20000	13400	199180
Uranium	30.0	20.1	299

Bacteriological (#/100 mL)	Standard
E. coli (30 Day Geometric Mean)	206
E. coli (Maximum)	668

Effluent Limitations for Protection of Recreation (Class 2B Waters)

Physical Parameter	Standard	Limit
pH Minimum	6.5	6.5
pH Maximum	9.0	9.0
Turbidity Increase (NTU)	10.0	

Bacteriological (#/100 mL)	Standard
E. coli (30 Day Geometric Mean)	206
E. coli (Maximum)	668

Effluent Limitations for Protection of Aquatic Wildlife (Assumed Class 3B Waters)

Temperature (deg C)	Standard
Instantaneous Maximum	27.0
Change Maximum	4.0

pH	Standard	Limit
Minimum	6.5	6.5
Maximum	9.0	9.0

Dissolved Oxygen (mg/L)	Standard
Instantaneous Minimum	5.0
7-day Average Minimum	6.0
30-day Average Minimum	5.5

BOD5 (mg/L)	Standard	Limit
7-day Average	N/A	35.0
30-day Average	N/A	25.0

Ammonia-Total (mg/L)	Season	Chronic (30-day ave)			Acute (1-hour ave)		
		Standard	Background	Limit	Standard	Background	Limit
	Summer	1.1	0.07	75.3	2.9	0.07	210.5
	Fall	1.2	0.07	83.4	1.3	0.07	94.5
	Winter	1.7	0.07	122.0	3.0	0.07	218.9
	Spring	1.7	0.07	121.6	2.5	0.07	180.5

Inorganics Parameter	Chronic Standard (4 Day Average) Standard	Acute Standard (1 Hour Average) Standard
Phenol (mg/L)		0.010
Hydrogen Sulfide (Undissociated) [mg/L]		0.002

Metals-Total Recoverable

Parameter	Chronic (4-day ave)			Acute (1-hour ave)		
	Standard ¹	Background	Limit	Standard ¹	Background	Limit
Aluminum (µg/L)	N/A ³	19.0	N/A	750	19.0	20,595
Arsenic (µg/L)	150	1.3	11,012	340	1.3	9,535
Cadmium (µg/L)	0.6	0.10	34.8	6.5	0.10	181
Chromium III (µg/L)	11.0	2.0	668	16.0	2.0	396
Chromium VI (µg/L)	199	2.0	14,625	1534	2.0	43,114
Copper (µg/L)	25.2	2.7	1,666	42.0	2.7	1,108
Cyanide (µg/L) ²	5.2	3.5	131	22.0	3.5	525
Iron (µg/L)				1000	27.0	27,415
Lead (µg/L)	9.1	0.2	660	234	0.2	6,579
Mercury (µg/L) ²	0.012	0.008	0.301	2.4	0.008	67.3
Nickel (µg/L)	145	5.0	10,344	1302	5.0	36,517
Selenium (µg/L) ⁴	4.6	2.2	4.6	18.4	2.2	18.4
Silver (µg/L)				25.7	0.5	711
Tributyltin (µg/L) ²	0.072	0.048	1.8	0.46	0.048	11.64
Zinc (µg/L)	329	17.0	23,123	326	17.0	8,726

1: Based upon a hardness of 335 mg/l as CaCO₃

2: Background concentration assumed 67% of chronic standard

3: Where the pH is equal to or greater than 7.0 and the hardness is equal to or greater than 50 ppm as CaCO₃ in the receiving water after mixing, the 87 ug/L chronic criterion (expressed as total recoverable) will not apply, and aluminum will be regulated based on compliance with the 750 ug/L acute aluminum criterion (expressed as total recoverable).

4: Due to impairment, limit is same as standard.

Organics [Pesticides]

Parameter	Chronic (4-day ave)		Acute (1-hour ave)	
	Standard	Limit	Standard	Limit
Aldrin (µg/L)			1.5	1.5
Chlordane (µg/L)	0.0043	0.0043	1.2	1.2
DDT, DDE (µg/L)	0.001	0.001	0.55	0.55
Diazinon (µg/L)	0.17	0.17	0.17	0.17
Dieldrin (µg/L)	0.0056	0.0056	0.24	0.24
Endosulfan, a & b (µg/L)	0.056	0.056	0.11	0.11
Endrin (µg/L)	0.036	0.036	0.086	0.086
Heptachlor & H. epoxide (µg/L)	0.0038	0.0038	0.26	0.26
Lindane (µg/L)	0.08	0.08	1.0	1.0
Methoxychlor (µg/L)			0.03	0.03
Mirex (µg/L)			0.001	0.001
Nonylphenol (µg/L)	6.6	6.6	28.0	28.0
Parathion (µg/L)	0.0130	0.0130	0.066	0.066
PCB's (µg/L)	0.014	0.014		
Pentachlorophenol (µg/L)	15.0	15.0	19.0	19.0
Toxephene (µg/L)	0.0002	0.0002	0.73	0.73

Radiological

Parameter	Maximum Concentration	
	Standard	
Gross Alpha (pCi/L)	15	

Effluent Limitation for Protection of Agriculture (Class 4 Waters)

Parameter	Maximum Concentration		
	Standard	Background	Limit
Total Dissolved Solids (mg/L)	1200	634	16,566
Boron (µg/L)	750	81.5	302,004
Arsenic, Dissolved (µg/L)	100	1.3	44,578
Cadmium, Dissolved (µg/L)	10	0.1	4,471
Chromium, Dissolved (µg/L)	100	2.0	44,263
Copper, Dissolved (µg/L)	200	2.7	89,112
Lead, Dissolved (µg/L)	100	0.2	45,074
Selenium, Dissolved (µg/L)	50	2.2	21,591
Gross Alpha (pCi/L)	15	10.1	2,246

Appendix B: Freshwater total ammonia criteria based on Title R317-2-14 Utah Administrative Code
 Acute Conditions

INPUT				
	Summer	Fall	Winter	Spring
pH:	8.6	9.0	8.5	8.6
Beneficial use classification:	3B	3B	3B	3B
OUTPUT				
Total ammonia nitrogen criteria (mg N/L):				
Acute:	2.912	1.345	3.025	2.507

Appendix B: Freshwater total ammonia criteria based on Title R317-2-14 Utah Administrative Code
 Chronic Conditions

INPUT				
	Summer	Fall	Winter	Spring
Temperature (deg C):	22.9	9.1	4.5	14.2
pH:	8.2	8.4	8.2	8.2
Are fish early life stages present?	Yes	Yes	Yes	Yes
OUTPUT				
Total ammonia nitrogen criteria (mg N/L):				
Chronic - Fish Early Life Stages Present:	1.086	1.195	1.717	1.711
Chronic - Fish Early Life Stages Absent:	1.086	1.694	2.788	1.751